

UNIT – IV HUMAN ANATOMY AND PHYSIOLOGY

IVA ENDOCRINE SYSTEM AND CHEMICAL CO-ORDINATION

Very Short Answer Questions

1. What is acromegaly? Name the hormone responsible for this disorder?

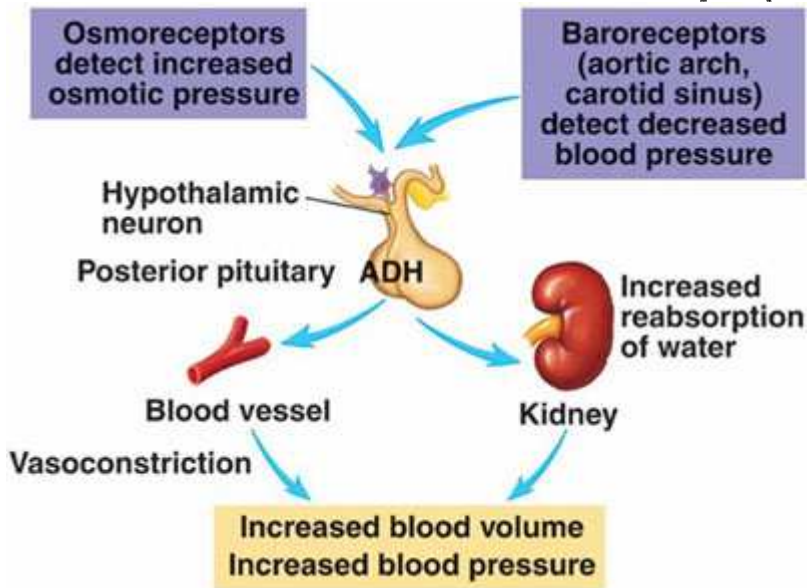
A. **Acromegaly** — It is a type of hormonal disorder which results due to hyper secretion of growth hormone (somatotropin) by pituitary gland in adult stages.

It is characterized by enlargement of the bones of the jaw, hand and feet, thickened nose, lips, eyelids and wide finger tips and gorilla like appearance of the person affected.

2. Which hormone is called anti –diuretic hormone? Write the name of the gland that secretes it?

A. **Vasopressin** is also called an anti – diuretic hormone.

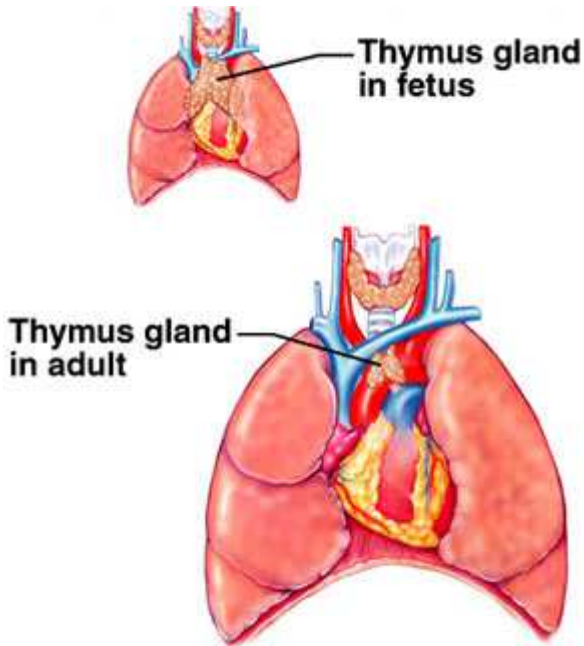
It is secreted by **hypothalamus** and stores in posterior pituitary/neurohypophysis.



3. Name the gland that increases in size during childhood and decreases in size during adulthood. What important role does it play in case of infection?

A. **Thymus** is small at birth; it increases in size during childhood and reaches maximum size at puberty. During adulthood, it shrinks to its size at birth.

In old persons, thymus gland is degenerated, resulting in a decreased production of thymosin. **Thymosin** plays an important role in immune developments. So immune response against infections of old people becomes weak.



4. Distinguish between diabetes insipidus and diabetes mellitus?

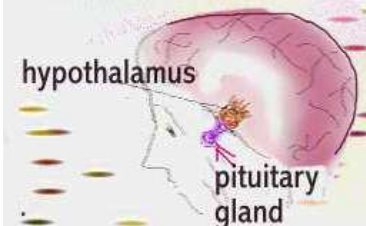
A. **Diabetes insipidus:** Deficiency of vasopressin/ADH causes a disease called diabetes insipidus. It is related to diuresis which is characterized by more water through urine. But it does not involve loss of sugar in urine.

Diabetes Mellitus: Low secretion of insulin by the pancreas (hypo-secretion) increases the level of glucose in blood is called hyperglycemia. Prolonged hyperglycemia leads to a disease called diabetes mellitus, associated with loss of glucose through urine and formation of ketone bodies.

Diabetes mellitus	Diabetes insipidus
It results from hyposecretion of insulin.	It results from hyposecretion of ADH.
Excretion of urine with sugar.	Excretion of large amounts of dilute urine.
Excessive eating.	Dehydration.

IDENTIFYING DIABETES INSIPIDUS VS. DIABETES MELLITUS

Diabetes Insipidus	Diabetes Mellitus
Source of the problem is caused by the pituitary gland in the brain. ADH (vasopressin is lacking)	Source of the problem is caused by the pancreas. The islets of Langerhans in the pancreas are not able to produce the insulin hormone to control blood glucose.
Signs and symptoms include : <ul style="list-style-type: none"> ✓ excessive urination, ✓ excessive thirst, ✓ elevated serum sodium and dehydration. 	Signs and symptoms include : <ul style="list-style-type: none"> excessive thirst, excessive urination, weight loss and fatigue elevated blood glucose.



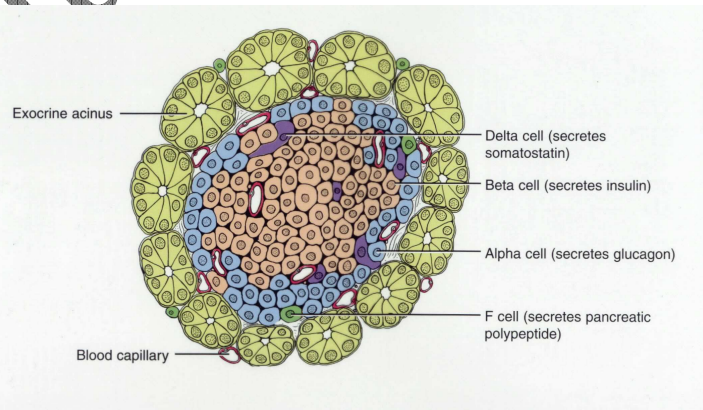
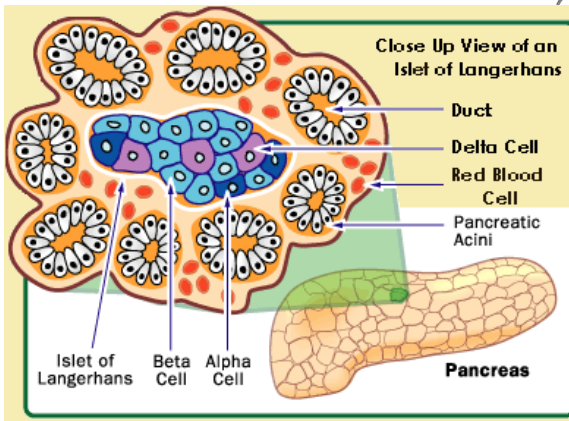
hypothalamus
pituitary gland

5. What are Islets of langerhans?

A. The endocrine region of pancreas contains 1 to 2 millions of **Islets of langerhans**.

There are two main types of cells α - cells and β - cells.

α - Cells produce the hormone **glucagon**, whereas β - cells produce **insulin**.



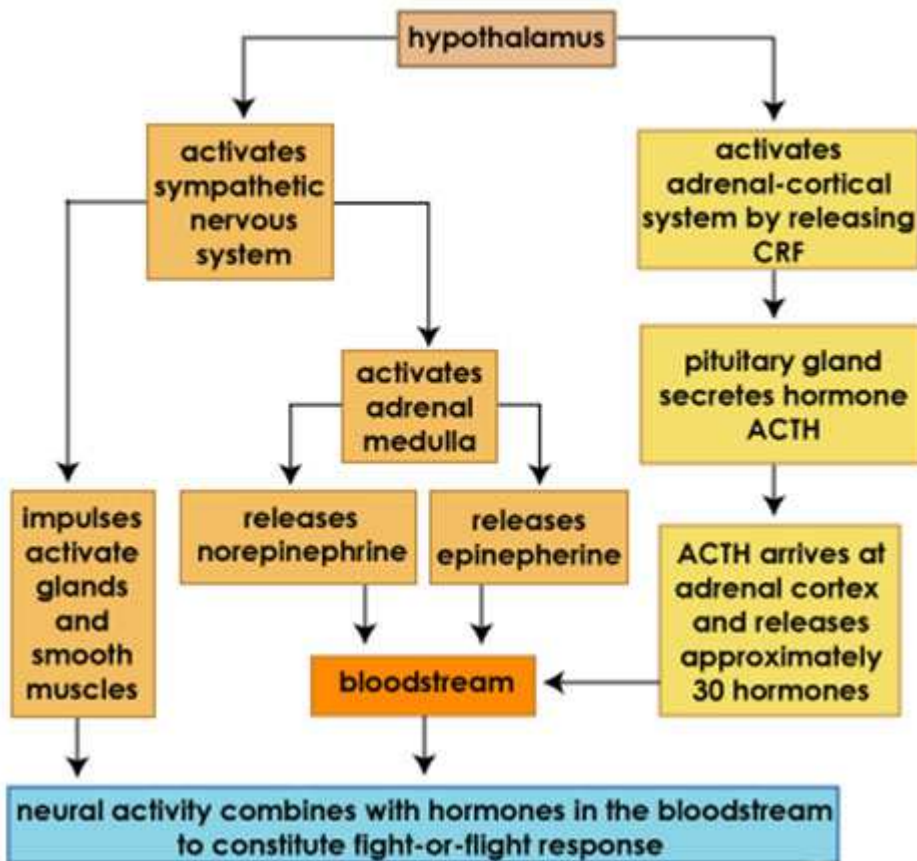
6. What is insulin shock?

A. Hyper secretion of insulin/ excess intake of insulin leads to decreased level of glucose in blood (hypoglycemia) resulting in **insulin shock**.

7. Which hormone is commonly known as fight and flight hormone?

A. **Epinephrine** and **norepinephrine** hormones are called fight and flight hormones or emergency hormones because these hormones are secreted in response to stress of any kind during emergency situations. They enhance alertness, dilation of pupils, piloerection (involuntary erection of hair on skin), sweating, dilation of the bronchioles etc.

Fight-or-flight Response



8. What are androgens, which cells secrete them?

A. **Androgens** are male sex hormones. E.g.: **Testosterone**.

Androgens are produced by the Leydig cells or interstitial cells of the testes and to a minor extent by the adrenal gland.

9. What is erythropoietin? What is its function?

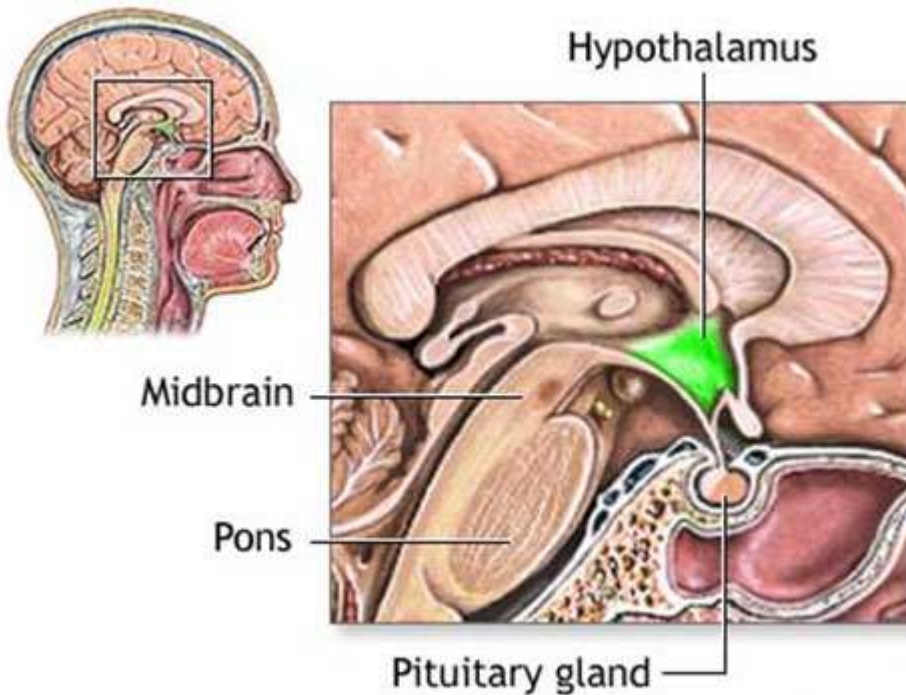
A. **Erythropoietin** is a hormone secreted by the juxtaglomerular cells of the kidney. It stimulates the erythropoiesis (in formation of RBC).

Erythropoietin controls the formation of RBC by regulating the differentiation and proliferation of erythroid progenitor cells in the bone marrow.

Short Answer Questions

1. List out the names of the endocrine glands present in human beings and mention the hormone they secrete?
 - A.
 - 1) **Hypothalamus:** It secretes releasing hormones and inhibiting hormones for pituitary hormones like growth hormone releasing hormone, growth hormone inhibiting hormone
 - 2) **Pituitary Gland:** Anatomically, it is divided into anterior and posterior pituitary.
 - a) **Anterior pituitary:** Produces growth hormone, prolactin, thyroid stimulating hormone, adrenocorticotrophic hormone, follicular stimulating hormone, luteinizing hormone.
 - b) **Posterior pituitary:** It releases two hormones namely Oxytocin and Vasopressin / ADH.
 - 3) **Pineal Gland:** It secretes a hormone called **Melatonin**.
 - 4) **Thyroid Gland:** It produces two hormones namely **Thyroxine** (T_4) and **Triiodothyronine** (T_3)
 - 5) **Parathyroid Gland:** Secretes a hormone called **Parathyroid hormone**.
 - 6) **Thymus Gland:** It secretes peptide hormone called **Thymosin**.
 - 7) **Adrenal Gland:**
 - a) **Adrenal cortex:** Secretes **Glucocorticoids, Mineralocorticoids, Androgens and Estrogens**
 - b) **Adrenal Medulla:** Produces **Epinephrine, norepinephrine**
 - 8) **Pancreas:** It secretes **Glucagon and Insulin**
 - 9) **Testes:** It secretes **Androgens and Testosterone**
 - 10) **Ovaries:** It produces **Estrogen and Progesterone**

2. Describe the role of hypothalamus as a neuro endocrine organ?



A. Hypothalamus is situated below the thalamus. It connects the neural and endocrine systems, as it is closely tied to the pituitary gland.

The hypothalamus is the master control centre of the endocrine system, as it contains several groups of neurosecretory cells called nuclei, which produce hormones called neurohormones. These hormones directly control the pituitary glands which in turn secrete hormones that regulate the growth and functioning of other endocrine glands.

For Example: The two types of hormones produced by the hypothalamus are:

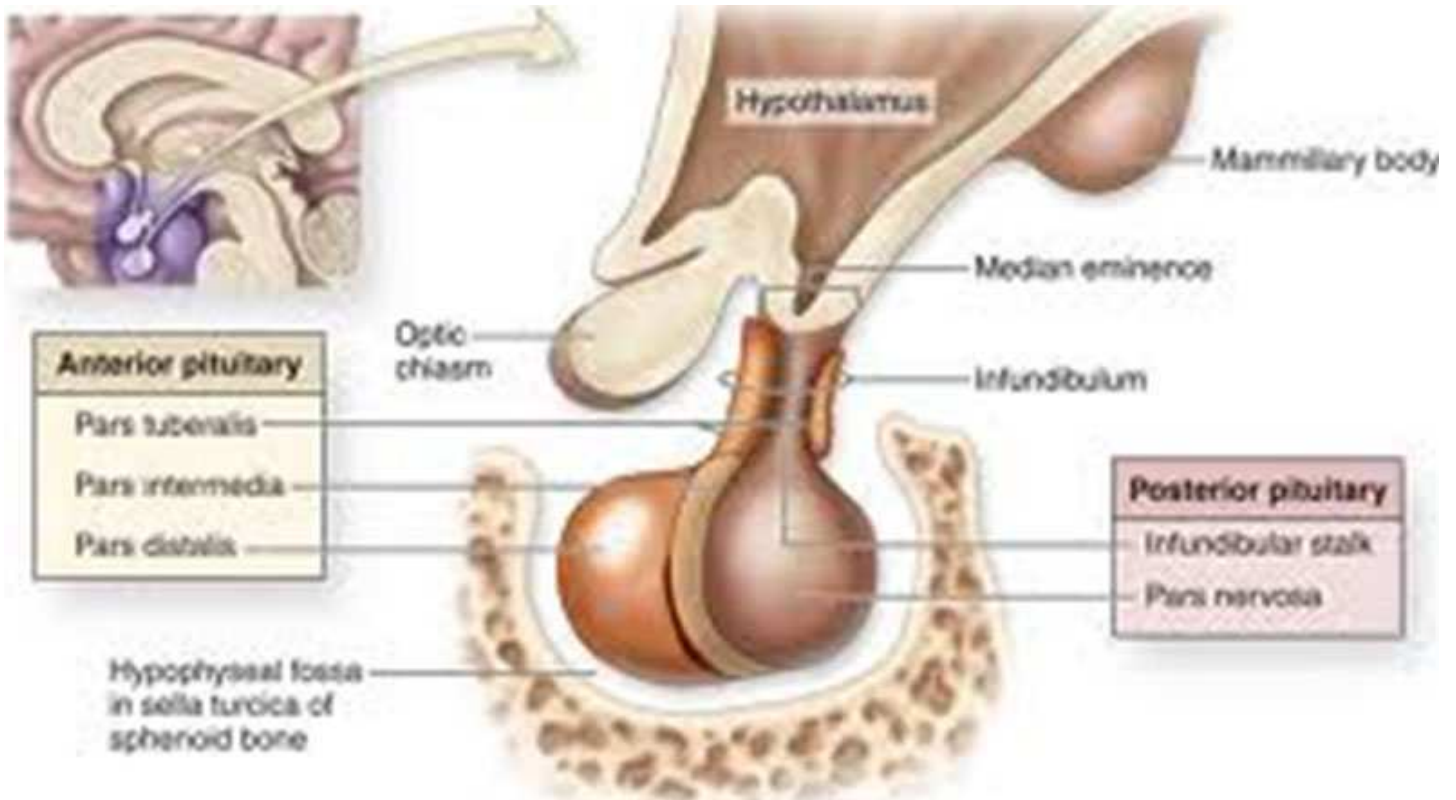
1) **Releasing Hormones:** It stimulates the secretions of pituitary hormones.

E.g.: 1) Growth hormone releasing hormone (GHRH, Somatocrinin) – stimulate the release of growth hormone from pituitary gland.

2) **Inhibiting hormones:** It inhibits the secretion of pituitary hormones.

E.g.: 1) Growth hormone inhibiting hormone (GHIH/Somatostatin) – inhibits the release of growth hormone from anterior pituitary.

3. Give an account of the secretions of pituitary gland?



A. The pituitary gland is also called hypophysis. Anatomically pituitary gland is divided into anterior and posterior pituitary.

I. Anterior Pituitary: It produces six important peptides. They are:

1) **Growth Hormone (GH) Somatotropin:** They promote growth of the entire body by increasing protein synthesis, cell division and cell differentiation.

2) **Prolactin:** It causes enlargement of the mammary glands of the breast and initiate the maintenance of lactation in mammals. Prolactin also promotes the growth of corpus luteum and stimulates the production of progesterone.

3) **Thyroid stimulating hormone (TSH):** It stimulates the production of thyroid hormones from thyroid gland.

4) **Adrenocorticotrophic hormone (ACTH):** Controls the production of steroid hormones called glucocorticoids, by the adrenal cortex.

5) **Follicle Stimulating Hormone (FSH):** It stimulates growth the development of the ovarian follicles in females. In males FSH along with the androgens, regulates spermatogenesis.

6) **Luteinizing hormone (LH):** In males it stimulates production of androgens. In females it stimulates the ovaries to produce estrogens and progesterone and it maintains corpus

luteum.

II. Posterior pituitary: It stores and releases two hormones called oxytocin and vasopressin.

Oxytocin: In females it stimulates contraction of pregnant uterus during child birth and ejection of milk from the mammary gland.

Vasopressin (ADH): Affects the kidney and stimulates reabsorption of water and electrolytes by the DCT and collecting duct.

4. **Compare a pituitary dwarf and a thyroid dwarf in respect to similarities and dissimilarities they possess?**

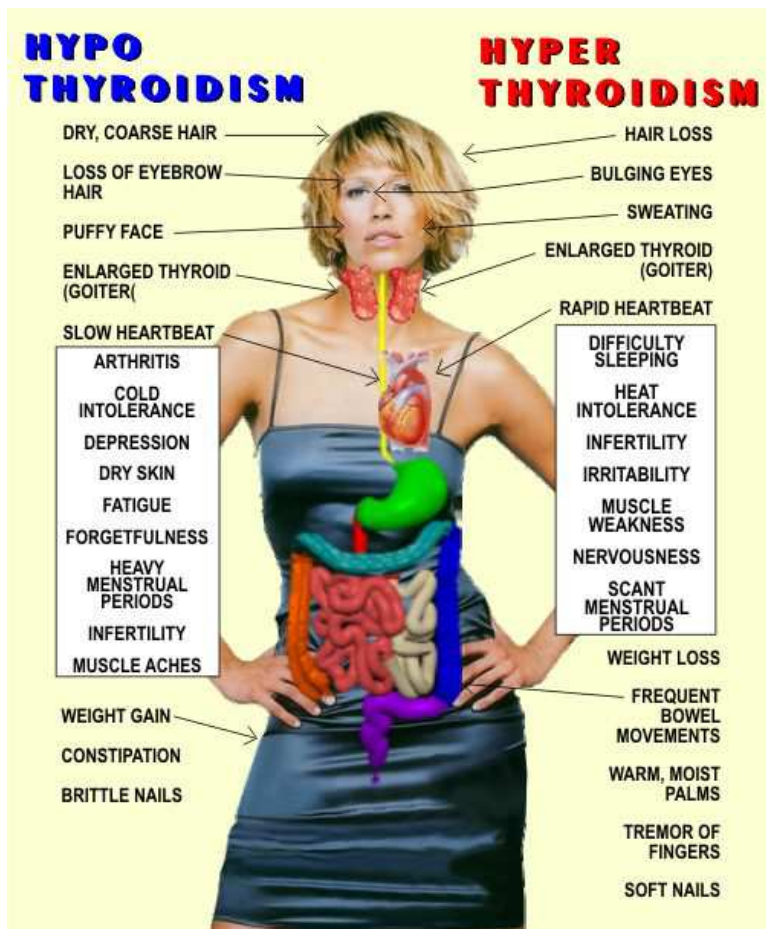
A.

Pituitary Dwarf	Thyroid Dwarf
1. Hypo secretion of growth hormone from pituitary during childhood retards growth resulting in pituitary dwarf.	1. Hypo secretion of thyroid hormones during pregnancy, defective development of baby, i.e. physical and mental growth get severely stunted, resulting in thyroid dwarf.
2. Human growth hormone deficiency results in abnormally slow growth and short structure with normal proportion.	2. Deficiency of thyroid hormones by birth results in enlarged head, short limbs, puff eyes, a thick and protruding tongue, dry skin, low I.Q, etc.
3. The pituitary dwarf is sexually and intellectually normal individual.	3. If the condition not treated the child will grow up dwarf, mentally retarded and sexually sterile.
4. Administration of purified HGH has been shown to induce skeletal growth in these patients.	4. Early treatment can result in normal growth and development.

5. Explain how hypothyroidism and hyperthyroidism can affect the body?

A. **Hypothyroidism:** Inadequate supply of iodine or impairment in the function of thyroid glands leads to decrease in production of thyroid hormones (T_3 and T_4) results in hypothyroidism and enlargement of the thyroid gland called simple goiter.

During pregnancy due to hypothyroidism, defective development of the growth body leads to a disorder called Cretinism. Physical and mental growth gets severely stunted due to untreated congenital hypothyroidism, stunted growth, mental retardation, low IQ, deafness and mutism are some characteristic features of this disease.



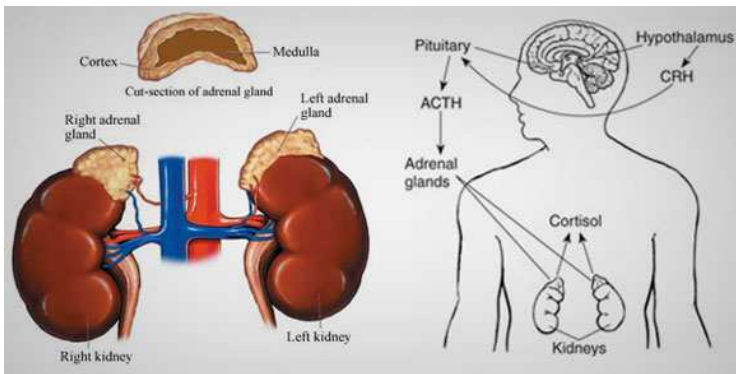
In adult women it may cause irregular menstrual cycles. Hypothyroidism in adult causes Myxoedema characterized by bagginess under the eyes, puffiness of face, dry skin, slowness in physical and mental activities.

Hyperthyroidism: Over activity of thyroid, cancer of the gland or development of nodule of thyroid lead to hyper thyroidism. In adults it causes an abnormal growth leads to a disease called Exophthalmic goiter with characteristically protruded eyeballs. Hyperthyroidism also affects the physiology of the body i.e., increased metabolic rate, nervousness, rapid heartbeat, sweating, increased appetite, etc.

6. Write a note on Addison's disease and Cushing's syndrome?

A. **Addison's disease:** It is caused due to hypo secretion of glucocorticoids by the adrenal cortex. This disease is characterized by loss of weight, muscle weakness, fatigue and reduced blood pressure. Sometimes darkening of the skin in both exposed and non – exposed parts of the body occurs in this disorder.

Cushing's syndrome: It results due to over production of glucocorticoids. This condition is characterized by breakdown of muscle proteins and redistribution of body fat resulting in spindly arms and legs, a round moon – face, buffalo hump on the back and pendulous abdomen is also observed. Wound healing is poor. The elevated level of cortisol causes hyperglycemia, over deposition of glycogen in liver and rapid gain of weight.



7. Why does sugar appear in the urine of a diabetic?

A. Hypo secretion of insulin of pancreatic gland increases the level of glucose in blood called hyperglycemia. Prolonged hyperglycemia leads to a disease called diabetes mellitus.

In a diabetic patient glucose or sugar appears in urine because kidney plays a special role in the homeostasis of blood glucose. Glucose is continuously filtered by the glomeruli, reabsorbed and returned to the blood. If the level of glucose in blood is above 160 - 180 mg/dl i.e., in hyperglycemia condition glucose in primary urine is not completely reabsorbed, and returned to the blood, some of which is retained and excreted in urine.

8. Describe the male and female sex hormones and their actions?

A. The hormones which are responsible for the development of secondary sexual characters and changes in different stages of life are called sex hormones.

Male sex Hormones:

Androgens: Androgens are produced by the Leydig cells of the testes and to a minor extent by the adrenal glands in both sexes.

Functions:

- Growth, development and maintenance of male reproductive organs
- Sexual differentiation and secondary sexual characteristics
- Spermatogenesis
- Male pattern of aggressive behaviour
- Increases the protein synthesis and increases the glycolysis

Female Sex Hormones:

1) Estrogens: Synthesized by the follicles and corpus luteum of ovary.

Functions:

- Development and maintenance of female reproductive system
- Maintenance of menstrual cycle
- Development of secondary sexual characters
- Estrogen promotes the protein synthesis and calcification and bone growth

2) Progesterone: It is synthesized and secreted by corpus luteum and placenta.

Functions: Required for implantation of fertilized ovum and maintenance of pregnancy.

3) Follicle stimulating and Luteinizing hormones: Both these hormones produced from anterior pituitary gland in both sexes.

Functions: Both these hormones play an important role in secondary sexual characters in both sexes.

9. Write a note on the mechanism of action of hormones?

A. Hormones are primary messengers which interact with receptors and they generate secondary messengers.

These secondary messengers regulate cellular metabolism in the target cells.

Mechanism of action of lipid insoluble hydrophilic hormone:

- The hormone binds to a stimulatory membrane bound receptor and stimulates 'G' protein.
- 'G' protein of the cell membrane binds to GTP and activates adenylate cyclase.
- Adenylate cyclase forms cAMP from ATP.
- cAMP activates the protein kinase, which activates the enzyme phosphorylase.

- Phosphorylase further phosphorylate the inactive enzyme and convert it to active form and involved in the metabolic process. **E.g.:** Epinephrine

Mechanism of action of lipid soluble hormone: Lipid soluble hormones easily diffuse through the cell membrane.

- It binds to a specific receptor in the cytoplasm forming hormone receptor complex molecule.

- This complex enters the nucleus and binds to the DNA and stimulates the production of specific m – RNA molecule.

- The m – RNA passes into the cytoplasm, where it is involved in the translation process and synthesizes a protein. These proteins produced by the cell as a response of hormone and play an important role in their respective metabolism.

E.g.: Aldosterone

